

REMARKS

Claims 1-28 are all the claims pending in the application.

Response to Claims Rejection Under § 103

Claims 1-28 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Dimitrova et al (V. Dimitrova, J. Tate, Synthesis and characterization of some ZnS-based thin film phosphors for electroluminescent device applications, Thin Solid Films 365 (2000) pages 134-138, hereinafter “Dimitrova”).

Applicants traverse, and respectfully request the Examiner to reconsider for the following reasons.

I. Polarity:

Regarding polarity, Dimitrova relates to “phosphors consisting of a material represented by $\text{ZnS}:\text{CuCl}_2$.” Although Dimitrova discloses the presence of both of Cu and Cl in the phosphor material, Dimitrova does not disclose or suggest that the phosphors have semiconductor properties. Namely, Dimitrova merely discloses a “phosphor.” Further, assuming *arguendo* that the phosphors of Dimitrova have some kind of semiconductor property, one cannot presume whether the phosphor exhibits p-type or n-type properties.

In contrast, the present inventors discovered that a semiconductor material comprising ZnSe and Cu of 5% forms a p-type semiconductor material, which of itself is a point of novelty aside from the claimed invention, and where it is known that an activation rate of Cl is higher than that of Cu. Namely, the Examiner is using improper hindsight in finding that the phosphors of Dimitrova (1) have semiconductor properties, and (2) are p-type semiconductors. That is, the Examiner could not have arrived at such conclusion in the absence of Applicants’ teachings in the specification.

II. Composition:

Regarding composition, according to the present invention, a stoichiometric composition satisfies the relationship wherein “the number of atoms $Zn+Cu+A+B$ is equal to the number of atoms $S+Se+Te$ (i.e., $Zn+Cu+A+B = S+Se+Te$).” Further, in the case where $\beta=\gamma=x=y=0$, a Zn site of ZnS is replaced by Cu. That is, Cu doping is utilized so as to maintain the stoichiometric composition, which is an essential configuration of the present invention.

In contrast, Cu doping, according to Dimitrova, is not utilized to maintain the stoichiometric composition, since such a composition is not an essential feature of Dimitrova. Rather, Cl is an essential component of the phosphor of Dimitrova, such that the Cu level is formed on the top of the valence band and the Cl level is formed on the top of the conductor, thereby generating light corresponding to a difference between the two levels.

According to the present invention, Cl is not an essential component. Thus, in the case where Cl is included in the presently claimed composition, as in Claim 5, constituent elements of Claim 1 (i.e., Zn, Cu, A, B, S, Se and Te) satisfy the stoichiometric composition and Cl serves as an additional dopant added to the constituent elements. Accordingly, the composition of the presently claimed material differs from that of the thin film composition of Dimitrova in that Dimitrova does not satisfy the presently claimed stoichiometric composition.

III. Object and Function:

As described above, a feature of the present invention is that the constituent elements “Zn, Cu, A, B, S, Se and Te” satisfy the term of which “the number of atoms $Zn+Cu+A+B$ is equal to the number of atoms $S+Se+Te$.” This configuration differs from Dimitrova.

In addition, according to the present invention, the presently claimed semiconductor material makes it is possible to regulate the resistivity by using a compensation dopant, Cl, (a

compensator) in addition to a Cu doping amount. In other words, in cases where it is difficult to control the density of the electron hole merely by changing the Cu concentration, it is possible to precisely control the carrier concentration by doping a compensation dopant such as Cl. *See*, paragraphs [0020] and [0021].

In contrast, the method of doping Cl according to Dimitrova is a method typically used for a phosphor material. In particular, Dimitrova discloses that, in the case of $\text{ZnS}:\text{CuCl}_2$, Cu and Cl are co-activators. Accordingly, Dimitrova fails to disclose or suggest a method of precisely controlling the carrier concentration.

Withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

Applicants further advise of certain inadvertent, clerical errors as follows. In Table 1 at page 33 of the specification, Zn (at%) for Example 3 should be ~~46~~ 48. Se (at%) for Example 2 should be ~~60~~ 50. Cu (at%) for Example 4 should be ~~5~~ 6. In Table 2 at page 35 of the specification, Se (at%) for Example 7 should be ~~60~~ 50. Applicants became aware of these clerical mistakes during foreign prosecution of a corresponding application, and offer to make the above-noted corrections at an appropriate stage of prosecution.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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Respectfully submitted,



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